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ABSTRACT

A total of 73 university freshman and 93 grade 7 and 8 students took part in a study of the differences in the affective meaning of color and black-and-white pictures. Subjects rated black-and-white and color slides on nine seven-point semantic differential scales and a red-blue scale. Results indicated that differences in affective meaning between color and black-and-white versions of pictures depend upon the nature of each individual picture, and for the most part cannot be generalized; however, the presence or absence of color does have an influence on the affective meaning of some pictures. The presence of color has a greater impact for younger subjects, who also appear to react more extremely to any picture, whether it is in color or black-and-white. There appears to be evidence that with both university and grade 7 and 8 students red is associated with activity, and activity is rated as "good." (CMV)

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# Differences in the Affective Meaning of Color and Black-and-White Pictures

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## DIFFERENCES IN THE AFFECTIVE MEANING OF COLOR AND BLACK-AND-WHITE PICTURES

The effects of the presence and absence of color in visuals upon various cognitive activities has never failed to intrigue researchers. There is a wealth of research into the role that color plays in the many kinds of learning that occurs when learners confront visual displays. There is some, though less, research into the way in which color acts upon affect. This research allows us to conclude that color is an important cueing device (Dwyer, 1971; Spangenberg, 1976), that color improves a learners's ability to recall both relevant and irrelevant material (Katzam and Nyenhuis, 1972) and that color is important to the meaning of a picture only when it is a critical attribute of the pictured object (Winn, 1976) or when attention is drawn to it (Winn and Schieman, 1977).

Once away from the cognitive domain, however, conclusions from research are drawn with less confidence. That color does influence the affective meaning of visuals is highly probable (Booth and Miller, 1974; Birren, 1973). Also, some of the effects reported by Winn and Schieman (1977) may well have been attributable to an affective component in the meaning of the pictures that they used since their method of free word association makes no distinction between affective and cognitive operations. However, beyond rather general and often imprecise conclusions, educational researchers have come up with little information concerning the impact of color in the affective domain.

The relationship between color and affective meaning has been studied quite extensively in the area of advertising. Of particular interest are studies that relate affective meaning to 'warm' and 'cold' colors, or the red-blue continuum. Gardner and Cohen (1966), Starch (1966), Gattengo (1963), and Lucus and Butt (1950), all studied the effects color had on the consumer when used in advertising. They found that color ads, both single addition and panchromatic, were more attractive and were 45-85% more effective than black-and-white ads. Lucus and Butt (1950) found that people often relate to color in hues of redish, yellowish, blueish and greenish rather than in specific terms. Another finding indicated that reaction to color is related to previous emotional experiences regarding certain colors. An early study by Adams (1920) discovered that the attention value of color could be arranged in the following order: orange, red, blue, black, green, yellow, violet, and grey.

Birren's (1973) analysis of people's perception of color also supports the notion that color is related to affective meaning. He noted that children and personalities more susceptible to affective influences prefered warmer colors (eg. reds and oranges) and older and more reserved persons prefered cooler shades such as blue. A liking for color was associated with extroversion and indifference to color with introversion.

Previous research by Birren (1969) also emphasized the affective impact of color. Color effects tended to be in two directions - towards red and blue. These two colors induce different levels of activation both in the autonomic nervous system and in the brain. Red had an exciting influence whereas blue tended to lessen activity. This reaction to color was subconscious.

Gerard (1958) had previously found similar results and noted that red was 'somewhat disturbing to the more anxious subjects'. In fact, 'the higher their chronic tension, the more they were affected physiologically and psychologically by red'. Blue, he found, had the reverse affect as the anxious subjects were relaxed and calmed by this color.

It seems likely, therefore, that reds, oranges and other 'warm colors', suggest brightness and activity while blues convey coldness and passivity. The presence of color in a picture should, then, increase the amount of these affective qualities present in its meaning.

The purpose of this study was to explore the impact of the presence of color on the affective meaning of pictures with more precision than most of the advertising studies. This was achieved by comparing the affective meaning of colored slides with that of their exact black-and-white equivalents. Affective meaning was determined by subjects' ratings of the slides on nine semantic differential scales. While possessing certain acknowledged weaknesses, the semantic differential does provide a useful and fairly reliable way to compare assessments of two sets of pictures. In addition, so that the obviously important 'warm-cold' dimension could be explored, a red-blue scale was added to the instrument.

Hypotheses were developed from the previous research into the meaning of color pictures and from research into advertising. These were:
-that color pictures would have significantly different mean ratings from black-and-white pictures on evaluation, potency, activity and color;

-that whether the scores for color slides were higher or lower than black-and-white means would depend on whether the picture was rated towards the red or blue end of the color scale.

-that slides rated towards the red end of the scale would tend to be rated good, potent and active.

The study was conducted with university freshmen, and replicated with grade seven and eight students.

# Method

Subjects: Seventy-three university freshmen, enrolled in introductory courses in communication at the University of Calgary, took part in the study. Since experimentation was carried out in normal class time with class groups, subjects were not randomly assigned to treatment groups. The color group had 36 subjects, the black-and-white group 37. For the replication, 93 grade seven and eight students took part, also in class groups. The color group had 44 subjects, and the black-and-white group 49.

Procedure: Forty color slides of a variety of subjects were selected for their high affective appeal. These slides were then rated by ten undergraduates on nine seven-point semantic differential scales. Each slide's score on the evaluation (optimistic-pessimistic), good-bad, (positive-negative), activity (excitable-calm, hard-soft, light-heavy) dimensions was calculated. From these results, the three highest and the three lowest slides on each of the three dimensions were chosen as representing extremes of the three qualities. Since four of these slides fell in the extremes of two scales, fourteen rather than eighteen slides were selected. Black-and-white copies were made of the fourteen slides. Seventy-three undergraduates were divided into two treatment groups. The two sets of slides were shown to their respective groups for thirty seconds each slide. Subjects rated the slides on the same scales as before, and on an additional red-blue scale. The experiment was repeated with the grade 7 and 8 students.

Analysis of Data: For each slide, evaluation, potency and activity scores were calculated for each subject. T-tests were performed on the color

and color ratings of each slide. These four scores were then combined for all slides, and t-tests repeated on the total scores. Correlation coefficients between the red-blue scores and the other three scores were calculated for the two treatment groups. The same analyses were performed for the study and the replication.

# Results

### University Students

Overall, only the mean scores of the color and black-and-white groups on the red-blue scale were significantly different, $t(71) = 1.48$, $P < .1$. Subjects seeing color slides rated them redder than those seeing black-and-white slides. In the cases of individual slides, however, other significant differences were found. These are presented in Table 1.

In both groups, significant positive correlations were found between red-blue scores and activity, red being the more active color. For the color group, $r = .41$, $P < .01$; for the black-and-white groups, $r = .26$, $P < .1$. In the color group, a significant positive correlation with evaluation suggested that slides rated red were also rated good, $r = .39$, $P < .01$. In the black-and-white group, a significant positive correlation of red-blue scores potency indicated that slides rated red were also rated more potent, $r = .29$, $P < .05$. In addition, for the color group, evaluation correlated positively with activity, $r = .57$, $P < .001$, and negatively with potency, $r = -,21$, which is not significant. The same was found in the black-and-white group. For evaluation and activity, $r = .47$, $P < .01$; for evaluation and potency, $r = -.49$, $P < .01$.

### Grade 7 and 8 Students

Overall, only the mean scores between the two treatment groups on the potency dimension were significantly different, $t(90) = 1.99$, $P < .05$. Subjects seeing color slides rated them less potent than subjects seeing black-and-white slides. Other significant differences were found in the cases of individual slides, and these are presented in Table 2.

As with the university students, significant positive correlations were found in both treatment groups between red-blue scores and activity, red being the more active color.For the color group, $r = .77$, $P < .001$; for the black-and-white group, $r = .77$, $P < .001$. In addition, for both groups, a positive correlation between color and evaluation suggested that slides rated red were also rated good. For the color group, $r = .70$,

$P < .001$; for the black-and-white group, $r = .66$, $P < .001$. In addition, correlations between evaluation and activity were found in both groups. For the color group, $r = .67$, $P < .001$; for the black-and-white groups, $r = .71$, $P < .001$. Also, evaluation correlated negatively with potency in the color group, $r = -.22$, $P < .1$.

### Post Hoc Analysis

Because there were some obvious differences between the two groups of subjects, both in the mean ratings for individual slides and in the correlations between dimensions of the semantic differential, analysis of variance was conducted *ex post facto* in order to compare differences between the two groups, and to test for group-by-treatment interactions. Results of this analysis are presented in Table 3.

On the evaluation dimension, the university students rated the slides significantly better than the grade 7 and 8 students, $F(1,162) = 17.86$, $P < .001$. On potency, black-and-white slides were rated more potent than color slides, $F(1,162) = 4.50$, $P < .05$. University students rated the slides more active than the younger subjects, $F(1,162) = 9.27$, $P < .01$. Finallly, university students rated the slides redder than the grade 7 and 8 subjects, $F(1,162), = 9.36$, $P < .01$, and subjects seeing color slides rated them redder than those seeing black-and-white slides, $F(1,162) = 3.43$, $P < .1$.

Interactions occurred only for three individual slides. For slide 2, on the evaluation dimension, a group-by-treatment interaction suggests that color made a greater difference in the ratings of grade 7 and 8 subjects than it did for the university subjects, $F(1,162) = 4,89$, $P < .05$. The same was found for slide 6 on evaluation, $F(1,162) = 4.00$, $P < .05$. On the potency dimension for slide 4, an interaction suggests that color has a greater effect on the potency of the slide perceived by the younger subjects, $F(1,162) = 7.49$, $P < .01$.

# Discussion and Conclusions

Conclusions drawn from the data reported above must be tempered with obvious limitations of the study. Subjects were not assigned to groups randomly, and no attempt was made to control other potentially influential group variables. However, the selection of class groups was such that these effects would be reduced. Also, in spite of a careful

selection and screening of slides, it is clear from the results that most color/black-and-white differences reside in individual slides and cannot be generalized to the whole set. This could either be the result of the highly varied content of the slides, or a consequence of a partial failure to select slides that have a highly affective appeal. Bearing these limitations in mind, it is nonetheless possible to draw the following conclusions.

**Differences in Affective Meaning**

For the university group, the ratings on the red-blue scale were the only ones that were different when pooled over all 14 slides. It is hardly surprising that the presence of color should have an effect on the perceived color of a picture. However, two further points need to be made. The first is that color slides were rated redder than black-and-white slides, which is probably due to the selection of more slides in which red dominated over blue. Inspection of the slides themselves bears this out. The second point is that the absence of overall differences on the three dimensions of the semantic differential indicates clearly that subjects were able to assess the 'color' of black-and-white slides as easily as they were able to assess it for color slides. This suggests that color does indeed have a more than superficial role to play in the meaning of pictures, and of affective meaning in general. Color is more than a purely visual phenomenon.

As far as individual slides are concerned, seven out of the 14 had significant differences between their colored and black-and-white versions on at least one of the three dimensions of affective meaning. Some of these, and one other, showed differences on the red-blue scale as well. Thus, ten slides give some support to the first hypothesis.

Of the three affective dimensions, activity was most frequently significantly different for the two treatments. When both activity and red-blue scores were significantly different (slides 4,5,7,9 in Table 1) the color slides rated red were always more active than their black-and-white counterparts, and vice versa. When only one of activity or red-blue scores were significantly different, in four instances out of five the means of the two groups followed the same pattern (slides 2,6,12,13). For the activity dimension hypothesis two received considerable support from university subjects.

Only one slide (slide 8) was rated differently by the two university groups on the evaluation dimension, and only two on potency (slides 2 and 4). It seems that for these subjects, the value and potency of a picture are not greatly affected by the presence or absence of color.

For the grade seven and eight subjects, there were some similarities, and some striking differences in the way in which the slides were rated when compared to the university subjects. Eight of the 14 slides showed significant difference on at least one of the four scores. Six of these showed differences on more than one score. With these subjects too, hypothesis 1 received support. In addition, redness predicted a high activity rating and blue a low one in every slide where both or one of the red-blue- and activity scales were significantly different (slides 4,6,8,11,12,13 in Table 2). However, the grade 7 and 8 subjects also rated some slides in ways different from their older counterparts.

To begin with, the overall ratings of the red-blue scale were not different for the two treatment groups of grade 7 and 8 subjects. This suggests that the younger subjects found it even easier to give color ratings to black-and-white slides than the university students. In addition, an overall difference was found in potency ratings, black-and-white slides being rated more potent. While only two slides were rated differently on potency by the university subjects, the grade 7 and 8 subjects rated 4 slides different on potency (slides 4,10,11,12). In every case, the black-and-white slide was rated more potent, and in every case the black-and-white slide was rated bluer, (though not necessarily significantly so). It is clear that color affects the perceived potency of younger subjects, with black-and-white slides being more potent and associated with blueness.

The younger subjects also assessed the two types of slides differently on evaluation that the university students. In the cases of 6 slides (slides 2,4,6,8,12,13) differences between black-and-white and color occurred on the evaluation dimension. In 4 of these slides, color was rated better than black-and-white. In these 4 cases, the color slides were also rated redder. In the two cases where the black-and-white slides were rated higher on evaluation (slides 6 and 8), the black-and-white slide was rated the redder of the two. It appears then that differences in evaluation scores between black-and-white and color slides are due not the the presence or absence of color but rather to the perceived redness of the slide. Slides rated red are perceived to be better than slides rated blue. Again, this is a striking example of ability of subjects to rate black-and-white slides on a red-blue scale, even to the extent of suppressing the actual color of the picture. It must be repeated; color is more than a visual phenomenon.

The prediction of the relative sizes of the means on the dimensions of the semantic differential from the perceived redness or blueness is far more striking in the grade 7 and 8 subjects than in the older subjects, giving even greater support to hypothesis two.

Inter-Scale Correlations

The correlations between the various semantic differential dimensions and the red-blue scale give support to hypothesis 3 and confirm many of the conclusions made above. In both groups, redness correlated positively with high activity. This confirms much of the research in advertising discussed above. Evaluation also correlated highly with the red-blue scale, except in the university black-and-white group. For younger subjects, and for old subjects seeing color pictures, it appears that pictures perceived to be red are also rated 'good'. Potency tends not to correlate with color, (though in the cases of some individual slides, it is associated with blueness).

It also appears to be characteristic of both age-groups that active slides are rated 'good' and potent slides are rated 'bad'. The exception here is the absence of correlation between potency and evaluation for grade 7 and 8 subjects seeing black-and-white pictures. These results move us a little bit away from color *per se*, but they do serve to identify what might be certain characteristics of the two samples with roots in cultural, rather than perceptual, phenomena. This question must be resolved elsewhere, however.

Age-Group Differences

Age-group main effects were significantly different on the evaluation, activity and red-blue dimensions. The university subjects rated their slides better, more active and redder than the grade 7 and 8 subjects. This is difficult to account for, and quite unforeseen. In all three cases, however, the scores of the university subjects were nearer to the midpoint on the seven-point scale (3.5), than the scoeres of the younger group. It could be that more mature subjects tend to be more conservative in their affective reactions to pictures, whether colored or black-and-white. This in turn might be due to more mature subjects reacting to the concept encoded by the picture rather than to the perceptual qualities of the picture. This latter notion receives a little support from the 3 significant interactions between age-group and treatment, all of which show color having a greater impact on the younger subjects than on the older ones. Both of these results suggest that, in interpreting the meaning of a picture, maturation is related to the ability of a subject to free himself from the physical properties of the sign to concentrate more on the object or event the sign stands for. Development appears to be related to the affective meaning a person derives from a picture.

Ratings of individual slides give further support to this conclusion. The socialization of the child will have a bearing on his rating of certain

slides. Slide 2 of a boy soldier was rated more potent by university subjects, who would be more sensitive to the tragedy in the picture, than by the grade 7 and 8 students. The university students' scores for both color and black-and-white suggested the slide was less active than the grade 7 and 8 subjects. The latter also rated the same slide higher on evaluation, although both groups rated the slide more negative than positive. The scores for slide 4 (an abstract picture of a tree) also suggest that perception of color is related to the maturation process. University students evaluated the slide more positively than the grade 7 and 8 subjects. Both groups had significant T scores on potency with university subjects suggesting that the colored version was more potent and the younger subjects stating the reverse. Both groups rated the color slide more active, but the difference in black-and-white color scores by university subjects was significant whereas for grade 7 and 8 it was not. Both groups rated the color slide more red. More evidence is found with slide 6. This slide featured a picture of a woman, possibly a parent or school teacher. In most cases, the grade 7 and 8 students rated the color slide higher than the black-and-white slide. The black-and-white slide was evaluated more positively, more active and more red than the color slide, but the activity mean and the red-blue means were more to the high end of the scale. University students rated the black-and-white slide more blue on the blue dimension, but in other respects, there was no difference in ratings between the two slides.

## Conclusions

The results of this study permit the following conclusions:

i. By and large, differences in the affective meaning between color and black-and-white versions of pictures depend upon the nature of each individual picture, and for the most part cannot be generalized.

ii. The presence or absence of color, however, does have an influence on the affective meaning of some pictures as measured by a semantic differential.

iii. The presence of color has a greater impact for younger subjects, who also appear to react more extremely to any picture, regardless of it being colored or black-and-white.

iv. There appears to be eveidence that with both university students and grade 7 and 8 students red is asssociated with activity, and activity is rated good.

v. There is also evidence that, with grade 7 and 8 students, red is considered good and also less potent.

Of course, an exploratory study such as this can be expected to provide no more than these rather general conclusions. More research is needed, with more careful sampling and pre-screening of slides, into the question of the affective meaning of color and black-and-white pictures. Particular attention needs to be given to the developmental aspect of color perception in the affective domain that emerged, unexpectedly, in this study. It might also be possible to conduct a study with color and black-and-white designs sufficiently abstract to remove any possiblity of subjects reacting to a concept rather than to the picture itself. In any event, affective meaning, and the affective impact of pictures is important for educators to study, and the research reported above provides enough evidence to suggest that color has an impact influence in affective meaning, and leaves sufficient questions unanswered to tempt researchers to explore further in the future.

# Table 1.

Mean ratings on individual slides (University Group)
(Low numbers - high amount)

| Slide | Evaluation | Potency | Activity | Red-Blue |
|---|---|---|---|---|
| 1. African Man | | | | |
| B and W | 2.87 | 3.99 | 3.57 | 3.57 |
| Color | 2.75 | 4.03 | 3.94 | 3.58 |
| 2. Boy Soldier | | | | |
| B and W | 5.43 | 2.22 | 4.10 | 4.00 |
| Color | 5.45 | 2.71<br>t = 1.94<br>p = .056 | 3.58<br>t = 1.97<br>p = .052 | 3.92 |
| 3. Lion and Carcass | | | | |
| B and W | 4.24 | 3.00 | 2.98 | 3.19 |
| Color | 4.27 | 2.97 | 3.44 | 3.00 |
| 4. Tree, Sunlight | | | | |
| B and W | 1.90 | 5.95 | 4.18 | 4.00 |
| Color | 1.98 | 5.36<br>t = 1.96<br>p = .054 | 3.44<br>t = 2.29<br>p = .025 | 2.25<br>2 = 4.51<br>p = .000 |
| 5. Flowers | | | | |
| B and W | 2.05 | 6.05 | 4.89 | 4.03 |
| Color | 1.99 | 5.97 | 4.41<br>t = 1.69<br>p = .095 | 2.56<br>t = 3.99<br>p = .000 |

| Slide | Evaluation | Potency | Activity | Red-Blue* |
|---|---|---|---|---|
| 6 Old Lady | | | | |
| B and W | 3.15 | 4.70 | 4.68 | 4.65 |
| Color | 3.08 | 5.00 | 4.83 | 5.36<br>t = 2.23<br>p = .029 |
| 7. Malcolm X | | | | |
| B and W | 5.50 | 1.95 | 4.36 | 3.81 |
| Color | 5.43 | 2.00 | 5.08<br>t = 2.60<br>p.011 | 4.72<br>t = 2.05<br>p = .044 |
| 8. Slum Buildings | | | | |
| B and W | 5.55 | 2.24 | 5.19 | 4.46 |
| Color | 6.04<br>t = 99<br>p = .050 | 2.01 | 5.20 | 4.56 |
| 9. Family On Beach | | | | |
| B and W | 1.61 | 6.11 | 2.59 | 3.51 |
| Color | 1.61 | 6.19 | 2.04<br>t = 2.60<br>p = .011 | 2.86<br>t = 1.63<br>(p = .108) |
| 10. Feather | | | | |
| B and W | 3.46 | 5.72 | 5.16 | 4.46 |
| Color | 3.30 | 5.69 | 4.99 | 5.47<br>t = 3.06<br>p = .003 |

| Slide | Evaluation | Potency | Activity | Red-Blue* |
|---|---|---|---|---|
| 11. Bridal Boquet | | | | |
| B and W | 1.94 | 5.76 | 3.50 | 3.81 |
| Color | 2.03 | 6.00 | 3.69 | 3.33 |
| 12. Girl Skipping | | | | |
| B and W | 1.86 | 5.01 | 2.15 | 3.00 |
| Color | 1.85 | 4.99 | 2.09 | 2.19<br>t=2.37<br>p=.020 |
| 13. Computer room | | | | |
| B and W | 4.15 | 2.74 | 5.13 | 4.73 |
| Color | 3.63 | 3.15 | 4.41<br>t=2.57<br>p=.012 | 4.19 |
| 14. Garbage | | | | |
| B and W | 5.69 | 2.11 | 5.27 | 4.51 |
| Color | 5.23 | 2.25 | 5.27 | 5.19 |
| Overall | | | | |
| B and W | 3.53 | 4.11 | 4.11 | 3.98 |
| Color | 3.50 | 4.17 | 4.03 | 3.80<br>t=1.82<br>p=.073 |

**On red-blue scale, low numbers indicate red end.*

# Table 2

Mean ratings on individual slides (Grades 7 and 8)
(Low numbers - high amount)

| Slide | Evaluation | Potency | Activity | Red-Blue* |
|---|---|---|---|---|
| 1. African man | | | | |
| B and W | 4.27 | 4.12 | 4.63 | 4.45 |
| Color | 4.38 | 3.83 | 4.41 | 4.82 |
| 2. Boy Soldier | | | | |
| B and W | 5.33 | 3.29 | 4.24 | 4.78 |
| Color | 4.84<br>t = 3.10<br>p = .003 | 3.31 | 4.20 | 4.48 |
| 3. Lion and Carcass | | | | |
| B and W | 4.51 | 3.57 | 3.71 | 3.94 |
| Color | 4.01 | 3.50 | 3.52 | 3.41 |
| 4. Tree; Sunlight | | | | |
| B and W | 3.13 | 4.48 | 4.08 | 3.69 |
| Color | 2.60<br>t = 1.64<br>p = .105 | 5.08<br>t = 1.97<br>p = .051 | 3.26<br>t = 2.27<br>p = .026 | 2.61<br>t = 2.52<br>p = .014 |

| Slide | Evaluation | Potency | Activity | Red-Blue* |
|---|---|---|---|---|
| 5. Flowers | | | | |
| B and W | 3.44 | 5.06 | 4.33 | 3.61 |
| Color | 2.97 | 5.31 | 4.46 | 3.45 |
| 6. Old Lady | | | | |
| B and W | 3.82 | 4.28 | 4.97 | 4.55 |
| Color | 4.37<br>t = 2.65<br>p = .009 | 4.14 | 5.59<br>t = 2.04<br>p = .044 | 5.27<br>t = 1.75<br>p = .084 |
| 7. Malcolm X | | | | |
| B and W | 4.84 | 3.73 | 5.03 | 4.69 |
| Color | 5.20 | 3.74 | 5.17 | 5.32 |
| 8. Slum Buildings | | | | |
| B and W | 4.76 | 3.28 | 5.04 | 4.61 |
| Color | 5.39<br>t = 2.06<br>p = .042 | 3.15 | 5.65<br>t = 2.25<br>p = .027 | 5.52<br>t = 2.37<br>p = .020 |
| 9. Family On Beach | | | | |
| B and W | 2.62 | 4.56 | 2.77 | 3.02 |
| Color | 2.39 | 4.97 | 2.73 | 2.48 |
| 10. Feather | | | | |
| B and W | 4.17 | 4.39 | 4.88 | 4.78 |
| Color | 4.30 | 5.03<br>t = 2.27<br>p = .026 | 5.23 | 4.66 |

| Slide | Evaluation | Potency | Activity | Red-Blue* |
|---|---|---|---|---|
| 11. Bridal Boquet | | | | |
| B and W | 3.56 | 4.53 | 4.16 | 4.20 |
| Color | 3.09 | 5.22<br>t = 2.31<br>p = .023 | 3.91 | 3.32<br>t = 2.06<br>p = .043 |
| 12. Girl Skipping | | | | |
| B and W | 3.95 | 4.05 | 3.82 | 3.92 |
| Color | 3.35<br>t = 1.79<br>p = .077 | 4.53<br>t = 1.82<br>p = .073 | 3.30 | 3.43 |
| 13. Computer room | | | | |
| B and W | 3.58 | 3.96 | 3.82 | 3.59 |
| Color | 2.80<br>t = 2.33<br>p = .022 | 3.86<br>t = 1.95<br>p = .055 | 3.17 | 3.14 |
| 14. Garbage | | | | |
| B and W | 5.37 | 3.52 | 5.31 | 5.33 |
| Color | 5.33 | 3.33 | 5.27 | 5.27 |
| Overall | | | | |
| B and W | 4.10 | 4.06 | 4.34 | 4.23 |
| Color | 3.93 | 4.21<br>t = 1.99<br>p = .049 | 4.28 | 4.08 |

# Table 3

Analysis of Variance and Means

| Evaluation | University | Grade 7 & 8 | |
|---|---|---|---|
| B and W | 3.53 | 4.10 | 3.82 |
| Color | 3.50 | 3.93 | 3.72 |
| | 3.52 | 4.02 | |

| | | |
|---|---|---|
| Group | $F(1.162 = 17.86$, | $p < .001$ |
| Treatment | $F(1.162) = 1.60$, | n.s. |
| GxT | $F(1,162) = .59$, | n.s. |

| Potency | University | Grade 7 & 8 | |
|---|---|---|---|
| B and W | 4.11 | 4.06 | 4.09 |
| Color | 4.17 | 4.21 | 4.19 |
| | 4.14 | 4.14 | |

| | | |
|---|---|---|
| Group | $F(1,162) = .018$, | n.s. |
| Treatment | $F(1,162) = 4.50$, | $p < .05$ |
| GxT | $F(1,162) = .705$, | n.s. |

| Activity | University | Grade 7 & 8 | |
|---|---|---|---|
| B and W | 4.11 | 4.34 | 4.23 |
| Color | 4.03 | 4.28 | 4.16 |
| | 4.07 | 4.31 | |

| | | |
|---|---|---|
| Group | $F(1,162) = 9.27$, | $p < .01$ |
| Treatment | $F(1,162) = .777$, | n.s. |
| GxT | $F(1,162) = .004$, | n.s. |

| Color | University | Grade 7 & 8 | |
|---|---|---|---|
| B and W | 3.98 | 4.23 | 4.11 |
| Color | 3.80 | 4.08 | 3.94 |
| | 3.89 | 4.16 | |

| | | |
|---|---|---|
| Group | $F(1,162) = 9.36$, | $p < .01$ |
| Treatment | $F(1,162) = 3.43$, | $p < .1$ |
| GxT | $F(1,162) = .05$, | n.s. |

| Slide 2, Eval. | University | Grade 7 & 8 | |
|---|---|---|---|
| B and W | 5.43 | 5.33 | 5.38 |
| B and W | 5.45 | 4.84 | 5.16 |
| Color | 5.44 | 5.09 | |
| | 5.44 | 5.09 | |

| | | |
|---|---|---|
| Group | $F(1,162) = 7.22$, | $p < .01$ |
| Treatment | $F(1,162) = 5.68$, | $p < .05$ |
| GxT | $F(1,162) = 4.89$, | $p < .05$ |

| Slide 6, Eval. | University | Grade 7 & 8 | |
|---|---|---|---|
| B And W | 3.15 | 3.82 | 3.49 |
| Color | 3.08 | 4.73 | 3.91 |
| | 3.21 | 4.26 | |

| | | |
|---|---|---|
| Group | $F(1,162) = 22.03$, | $p < .001$ |
| Trearment | $F(1,162) = 3.87$, | $p < .1$ |
| GxT | $F(1,162) = 4.00$, | $p < .05$ |

| Slide 4, Potency | University | Grade 7 & 8 | |
|---|---|---|---|
| B and W | 5.95 | 4.48 | 5.22 |
| Color | 5.36 | 5.08 | 5.22 |
| | 5.66 | 4.78 | |

| | | |
|---|---|---|
| Group | $F(1,162) = 17.01$, | $p < .001$ |
| Treatment | $F(1,162) = .132$, | n.s. |
| GxT | $F(1,162) = 7.49$, | $p < .01$ |

# References


Adams, H.F. *Advertising and Its Mental Laws.* New York: MacMillan Co., 1920.

Birren, F. The effects of Color on the Human Organism.*American Journal of Occupational Therapy,* May-June 1959.

Birren F. Color Preference as a Clue to Personality. *Art Psychotherapy,* Vol. 1, April 1973. pp. 13-16.

Booth, G. D. and Miller H. R. Effectiveness of Monochrome and Color Presentations in Facilitating Affective Learning. *Audio Visual Communication Review,* Vol. 22, No. 4, Winter 1974. pp. 409-422.

Dwyer, F. Color as an Instructional Variable. *Audio Visual Communication Review,* Vol. 19, No. 4, Winter 1971. pp. 399-413.

Garden, B., and Cohen, A. ROP Color and its Effect on Newspaper Advertising. *Journal of Marketing Research,* November, 1966, pp. 365-371.

Gattengno, C. Teacher's Guide, Words in Color. Chicago: Encyclopaedia Brittanica Press, 1963.

Gerard, R. Color and Emotional Arousal. *American Psychologist.* July 1958.

Katzman, N. and Nyenhuis, J. Color vs. Black and White Effects on Learning, Opinion and Attention. *Audio Visual Communication Review,* Vol. 20, No. 1, Spring 1972. pp. 16-28.

Lucus, D. B. and Britt, S. H. *Advertising Psychology and Research.* New York: McGraw - Hill Book Co.Inc. 1950.

Spangenberg, R. Which Is Better for Learning? Color or Black and White? *Audio Visual Instruction,* June 1976. p.80.

Starch, D. *Measuring Advertising Readership and Results.* New York: McGraw - Hill Book Co., 1966.

Winn, W. D. and Schieman, E. The Effects of the Removal Of Common Meaning on the Structure of Free Associations to Black-and-White and Color Pictures. Presented at the annual convention of the Association for Educational Communication and Technology, Miami Beach, April 1977.

Winn, W. D. The Structure of Multiple Free Associations Towards Black-and-White Pictures and Color Pictures. *Audio Visual Communication Review*, 1976, Vol. 24, pp. 273-293.